snapAG TECHNOLOGY & INNOVATION

ROBOTICS IN AGRICULTURE

Robotics is changing the way we farm.

Robotics is a branch of engineering technology involving the design, manufacture and operation of robots. They often use sensors and/or cameras to take in detailed information about their environment to function effectively. A **robot** is a computer-operated machine capable of automatically carrying out a complex series of pre-programed actions.[1]

Agricultural robots are a branch of **precision agriculture**, farm management practices that use information technology to optimize plant and animal health and productivity.[2] Robotics are expected to revolutionize farming in the future.

Self-driving tractor

In the future, farm machinery will drive itself!

Autonomous (self-driving) vehicles are robots that can seed, fertilize and apply pesticides to thousands of acres of crops. Even though robots will do more jobs on farms, humans will still be essential to service the equipment, operate the robots and manage operations.

Robots to the rescue

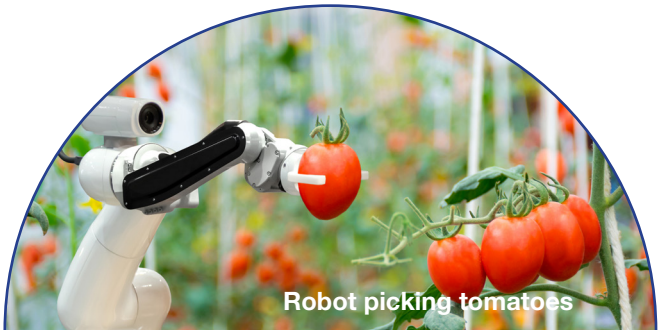
- **They replace the need for human workers.** There's a growing labour crisis in agriculture. Within 10 years the industry expects a shortage of 123,000 workers,[3] which will result in farmers not being able to grow and harvest as much food.
- **Robots outperform people.** They can work around the clock without getting fatigued or needing breaks, and also make fewer mistakes.
- **Robots use resources efficiently.** They are able to apply precise amounts of water,[5] seeds, fertilizer and pesticides to specific areas – or even specific plants.[6]
- **They help prevent waste.** Because farmers don't have to rely on finding people to harvest food, robots ensure crops are harvested before they lose quality or go bad.[7]
- **They do the hard work.** Robots are capable of repetitive and potentially dangerous tasks. This reduces injuries and accidents for humans while freeing up people to perform higher level tasks.[4]

Greenhouse robot watering lettuce

WHY DON'T ALL FARMS USE ROBOTS?

While the technology exists, design of the machinery or equipment sometimes doesn't stand up to harsh agricultural conditions, like extreme temperatures, dust or humidity.[8] Robotics can also be very expensive.

ROBOTICS IN ACTION


Robot picking tomatoes


Robotic milker

On dairy farms

Robotic milkers are free standing cubicle structures that cows enter to be milked without human supervision. Robots learn each cow's udder shape and stance making milking quicker and easier. They can also alert the farmer if a cow's behaviour changes, which may indicate sickness.

Cows are usually milked by farmers 2-3 times a day on a set schedule. But when robots do the milking, cows can decide when they want to be milked, 24/7!

Between 2016 and 2019, the use of robotic milkers grew from 8.24% to 13.78% on Canadian dairy farms.[9]


Drone

In the sky

Drones, also called **unmanned aerial vehicles** (UAVs),[14] collect data on crops like **grains** (wheat, barley and oats) and **oilseeds** (mustard, canola). They use satellite imagery and remote-sensing technology to determine plant health and scout for harmful **pests** (weeds, insects and disease). They can also identify areas in each field that may need more or less nutrients (**fertilizer**), which helps farmers become more efficient and environmentally friendly.

DYK? Robots can learn.

Artificial Intelligence (AI) is the ability of machines to learn from experience, and adjust to new information.[12] Crop monitoring robots equipped with AI can learn to tell the difference between plants and weeds, apply herbicides or pull a weed, or identify a harmful insect and apply a **microdose** (a very small amount) of the correct insecticide.[13]


Mini cucumber packer

In greenhouses

Harvesting is a difficult job that requires many skilled workers for short, intense periods of time. **Robotic harvesting arms** have sophisticated technology to distinguish between underripe and "ready to harvest" fruit or vegetables. They can also pick produce from plants without bruising or damaging delicate skins.[10]

Spacing plants is a physically demanding task in a nursery or greenhouse – and perhaps the most critical. Plants placed too close together won't have enough room to grow; too far apart and greenhouses will not be able to produce as much. The job of **plant spacing robots** is to consistently position plants in the ideal position 24/7.[11]